BIBLIOGRAPHY OF THERMAL METHODS OF OIL RECOVERY

By W. T. Wertman, N. A. Caspero, and T. E. Sterner

* * * * * * * * * * * information circular 7958

MARCH 3, 1849

UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary

BUREAU OF MINES
Marling J. Ankeny, Director

This publication has been cataloged as follows:

Wertman, William T

Bibliography of thermal methods of oil recovery, by W. T. Wertman, N. A. Caspero, and T. E. Sterner. [Washington] U.S. Dept. of the Interior, Bureau of Mines [1960]

iii, 13 p. 26 cm. (U.S. Bureau of Mines. Information circular 7958)

1. Petroleum mining - Bibl. 2. Secondary recovery of oil - Bibl.
I. Title: Thermal methods of oil recovery. (Series)

TN23.U71 no. 7958 622.06173

U.S. Dept. of the Int. Library

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. – Price 20 cents

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BIBLIOGRAPHY OF THERMAL METHODS OF OIL RECOVERY[1]

BY

W. T. WERTMAN,[2] N. A. CASPERO,[2] AND T. E. STERNER[3]

INTRODUCTION

LABORATORY research has been started at the Bureau of Mines Morgantown Petroleum Research Laboratory, Morgantown, W. Va., to investigate the possibilities of thermal-recovery methods for producing crude oils of high API gravity found in oil reservoirs of the eastern United States. This bibliography on thermal methods of oil recovery was compiled as a part of the work.

Crude oil discoveries to December 31, 1958, in the United States were estimated to exceed 270 billion barrels. Cumulative production of crude oil through 1958 was about 60 billion barrels, and the American Petroleum Institute estimates that an additional 30.5 billion barrels are economically recoverable by present methods. On this basis, about two-thirds of the oil that has already been found can be classified as economically unrecoverable for lack of a satisfactory method.

The rapidly rising costs of proving new deposits of domestic petroleum, the lack of new discoveries of large oilfields in the United States, and the growing demand for crude oil have caused an acceleration of research to develop new or improved methods for producing "unrecoverable" oil in known reservoirs.

The use of heat to stimulate oil production has received considerable attention in recent years. Several thermal-recovery methods, now in the early stages of development and application, may be of greater potential benefit than water flooding or gas-injection recovery because 60 to 70 percent of the oil originally in place may be recovered. Continued improvements in these methods promise that much of the oil classified as unrecoverable by present methods could be economically produced.

Thermal methods seem to have their most effective application in recovery of low-gravity (API) crude oils but are not limited to the production of these heavy oils. Several methods involve gas- and liquid-drive mechanisms in addition to supplying heat to the reservoir, and these mechanisms may be very effective in producing light crude oils. However, the application of thermal methods to produce high-gravity (API) crude oil has not been very extensively developed because other oil-recovery processes, such as waterflooding or gas injection, are being used effectively to produce these high-gravity crude oils from reservoirs. An exception is the use of heat in well-reconditioning work to remove paraffin deposits.

Heating production wells to improve recovery rate and ultimate recovery is the oldest known application of heat to oil reservoirs. Direct injection of hot fluid (water, gas, or steam) to reduce oil viscosity is another method of applying heat to a reservoir to stimulate oil production. Results of laboratory work have shown that elevation of injection-water temperature will improve oil-displacement efficiency.

Underground combustion is a thermal oil-recovery method whereby the necessary energy is furnished by injecting air into the reservoir and burning part of the crude oil. The process basically consists of (1) injecting air into a reservoir to establish a flow path for movement of combustion gases, (2) igniting the crude oil at the injection well, and (3) propagating the combustion front through the reservoir by continued air injection. The narrow, burning zone advances radially from the injection well and moves the oil to the production well. Fuel for combustion is supplied by heavy, residual material (coke) that has been deposited on the sand during distillation and crack-

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ing the crude oil ahead of the combustion front and/or by combustible gas mixed with the air that is injected.

Recovery of petroleum by underground combustion is not a new idea. A process was patented for supplying heat by burning oil and combustible gas in a well, 36 years ago in the United States. Soviet engineers reported on field experiments with a crude-oil gasification process in 1935. In 1952 engineers of Sinclair Oil & Gas Co. and Magnolia Petroleum Co., independently, conducted field tests in the midcontinent area of the United States. Since that time, seven additional field tests have been completed. Nine projects are underway at present, and at least nine projects are in various stages of planning.

Field tests of underground combustion have used the following variations: (1) Continuous injection of air causing the flame front to burn steadily as it moves from input to producing wells, (2) formation of a large heat wave to be moved by gases of limited oxygen content to control the rate of burning, and (3) stopping combustion part way between the injection and production wells and moving the heat wave toward the production well by cycling the produced gases.

Reverse combustion is another variation of the underground combustion method. No field tests of this approach have been reported in the literature. In this procedure, combustion is initiated at the production well, and a burning zone is propagated from the production well to the air-injection well. Oil is recovered by vaporization and thermal cracking, and passes mostly in the vapor phase through the burned-out, hot formation to production wells.

This bibliography includes 249 references to U.S. patents and published literature relating to thermal processes of oil recovery. Some of the references pertain to specific processes of coal gasification and shale oil extraction; however, these references were included because of their possible application to oil sands.

An effort has been made to include references on thermal oil-recovery methods to June 1959. The bibliography is divided into the following sections: (1) U.S. patents, (2) literature references, and (3) an author index. The patents and literature references are listed alphabetically by author by intervals of years.

UNITED STATES PATENTS

1899–1925

1. **Baker**, D. R. Apparatus for Extracting the Volatilizable Contents of Sedimentary Strata. U.S. Patent 895,612, Aug. 11, 1908.
2. **Clark**, C. Process of Subterranean Distillation of Volatile Mineral Substances. U.S. Patent 1,510,655, Oct. 7, 1924.
3. **Cooper**, A. S. Apparatus for Raising Bituminous Sand From Wells and Separating Bitumen From Its Impurities. U.S. Patent 636,117, Oct. 31, 1899.
4. **Day**, D. T. Process for Extracting Oils and Hydrocarbon Material From Shale and Similar Bituminous Rocks. U.S. Patent 1,342,741, June 8, 1920.
5. **Hoover**, W. W., and **Brown**, T. E. Method for Working Oil Shales. U.S. Patent 1,422,204, July 11, 1922.
6. **Howard**, F. A. Method of Operating Oil Wells. (Assigned to Standard Oil Development Co.). U.S. Patent 1,473,348, Nov. 6, 1923.
7. **Snelling**, W. O. Method of Treating Oil Wells. U.S. Patent 1,104,011, July 21, 1914.
8. **Squires**, F. Apparatus for and Method of Recovering Oil and Gas. (Assigned to Walter Squires, Zanesville, Ohio.) U.S. Patent 1,249,232, Dec. 4, 1917.
9. ———. Recovery of Oil From Oil-Sands. (Assigned to Walter Squires, Zanesville, Ohio). U.S. Patent 1,263,618, Apr. 23, 1918.
10. **Wolcott**, E. R. Method of Increasing the Yield of Oil Wells. U.S. Patent 1,457,479, June 5, 1923.

1926–40

11. **Claytor**, E. E. Apparatus for Mining. (Assigned to Charles Paul Mackie, Newark, N.J. U.S. Patent 1,607,586, Nov. 16, 1926.
12. ———. Method and Apparatus for Recovering Oil From Loose Oil Bearing Strata. (Assigned to Charles Paul Mackie, Newark, N.J.) U.S. Patent 1,612,611, Dec. 28, 1926.
13. **Crawshaw**, R. Apparatus for Extracting Oil From Shale Deposits by Heating in Situ. U.S. Patent 1,666,488, Apr. 17, 1928.
14. **Hixon**, H. W. Apparatus for Recovering Oil From Subterranean Oil Pockets. U.S. Patent 2,188,737, Jan. 30, 1940.
15. **Karrick**, L. C. Underground Gasification of Carbonaceous Material Bearing Substances. U.S. Patent 1,913,395, June 13, 1933.
16. **Ranney**, L. Apparatus for Recovering Oil. (Assigned to Standard Oil Development Co.). U.S. Patent 1,660,818, Feb. 28, 1928.
17. **Rich**, J. L. Process and Means for Extracting Petroleum. U.S. Patent 1,735,012, Nov. 12, 1929.
18. **Uren**, L. C. Flooding Method for Recovering Oil. (Assigned to Standard Oil Development Co.) U.S. Patent 1,735,481, Nov. 12, 1929.

1941–50

19. **Barton**, P. D., and **Dougherty**, P. F. Method of Producing Petroleum. (Assigned to Sun Oil Co.) U.S. Patent 2,390,770, Dec. 11, 1945.
20. **Cross**, R. Method for Secondary Recovery of Oil. U.S. Patent 2,386,036, Oct. 2, 1945.
21. **Frey**, F. E. Method of Recovery of Hydrocarbons. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,382,471, Aug. 14, 1945.
22. **Greene**, F. C. Generation of Synthesis Gas. (Assigned to In Situ Gases, Inc.) U.S. Patent 2,466,945, Apr. 12, 1949.
23. **Ranney**, L. Method for Producing Oil From Viscous Deposits. U.S. Patent 2,365,591, Dec. 19, 1944.
24. **Steffen**, R. M. Underground Oil Recovery. U.S. Patent 2,421,528, June 3, 1947.
25 **Uren**, L. C. Process and Apparatus for Recovery of Volatilizable Constituents From Underground Carbonaceous Formations. (Assigned to Texaco Development Corp.) U.S. Patent 2,481,051, Sept. 6, 1949.

1951–55

26. **Evans**, L. P. Subterranean Retorting of Shales. (Assigned to Socony-Vacuum Oil Co.) U.S. Patent 2,630,306, Mar. 3, 1953.
27. **Huff**, L. C. Process for Conversion of a Mixture of Hydrocarbonaceous Solids and Liquid Hydrocarbons. (Assigned to Universal Oil Products Co.) U.S. Patent 2,587,729, Mar. 4, 1952.
28. **Kaasa**, O. G. Apparatus. (Assigned to Sinclair Oil & Gas Co.) U.S. Patent 2,722,278, Nov. 1, 1955.
29. **Ljungström**, F. Method of Electrothermal Production of Shale Oil. (Assigned to Svenska Skifferolje Aktiebolaget, Orebro, Sweden.) U.S. Patent 2,634,961, Apr. 14, 1953.
30. **Martin**, J. W. Method of Recovering Oil From Oil Shale. (Assigned to Carbonic Products, Inc.) U.S. Patent 2,630,307, Mar. 3, 1953.
31. **Mayes**, G. C., and **Koch**, R. L. Method of Initiating Subterranean Combustion. (Assigned to Socony-Vacuum Oil Co.) U.S. Patent 2,670,-047, Feb. 23, 1954.
32. **Merriam**, E. S., and **Squires**, F. Thermal Drive Method for Recovery of Oil. U.S. Patent 2,584,605, Feb. 5, 1952.
33. **Pearce**, F. G., and **Latta**, J. E. Method for Gasification of Subterranean Carbonaceous Deposits. (Assigned to Stanolind Oil & Gas Co.). U.S. Patent 2,695,163, Nov. 23, 1954.
34. **Piros**, J. J., and **Campbell**, O. F. Gas Burner and Burning Gas in Oil and Gas Wells. (Assigned to Sinclair Oil & Gas Co.) U.S. Patent 2,668,592, Feb. 9, 1954.
35. **Smith**, R. L., and **Watson**, K. M. Oil Recovery Process. (Assigned to Sinclair Oil & Gas Co.) U.S. Patent 2,642,943, June 23, 1953.

1956

36. **Barclay**, H. A., and **Nichols**, D. P. Subsurface Igniter. (Assigned to Socony Mobil Oil Co.) U.S. Patent 2,771,140, Nov. 20, 1956.
37. **Ljungström**, F. Method of Treating Oil Shale and Recovery of Oil and Other Mineral Products Therefrom. (Assigned to Svenska Skifferolje Aktiebolaget, Orebro, Sweden.) U.S. Patent 2,732,195, Jan. 24, 1956.

38. Simm, C. N. Method of Heating Subterranean Formations. (Assigned to California Research Corp.) U.S. Patent 2,747,672, May 29, 1956.
39. ———. Method of Oil Recovery by In Situ Combustion. (Assigned to California Research Corp.) U.S. Patent 2,771,951, Nov. 27, 1956.
40. ———. Method of Consolidating Subterranean Formations. (Assigned to California Research Corp.) U.S. Patent 2,771,952, Nov. 27, 1956.
41. Stewart, J., Fulton, S. C., and Langer, A. W., Jr. Recovery of Oil From Bituminous Sands. (Assigned to Esso Research & Engineering Co.) U.S. Patent 2,772,209, Nov. 27, 1956.

1957

42. Behning, P. D., Glass, E. D., and Rzasa, M. J. Oil Recovery by Underground Combustion. (Assigned to Pan American Petroleum Corp.) U.S. Patent 2,803,305, Aug. 20, 1957.
43. Bond, D. C. Increasing Production Rates of Gas and Oil Wells. (Assigned to Pure Oil Co.) U.S. Patent 2,796,935, June 25, 1957.
44. Crawford, P. B. Recovery of Petroleum Oil From Partially Depleted Subterranean Reservoirs. U.S. Patent 2,804,146, Aug 27, 1957.
45. Dixon, H. O. Production of Oil by In Situ Combustion. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,818,118, Dec. 31, 1957.
46. Fatt, I. Process for Treating Oil Well Formations. (Assigned to California Research Corp.) U.S. Patent 2,799,342, July 16, 1957.
47. Fisher, F. R., and Pelzer, H. L. Thermal Process for In Situ Decombustion of Oil Shale. (Assigned to Sinclair Oil & Gas Co.) U.S. Patent 2,780,449, Feb. 5, 1957.
48. Koch, R. L. Initiation of Combustion in a Subterranean Petroleum Oil Reservoir. (Assigned to Socony Mobil Oil Co.) U.S. Patent 2,818,117, Dec. 31, 1957.
49. Ljungström, F. Recovering Subsurface Bituminous Deposits by Creating a Frozen Barrier and Heating In Situ. (Assigned to Svenska Skifferolje Aktiebolaget, Orebro, Sweden.) U.S. Patent 2,777,679, Jan. 15, 1957.
50. ———. Device for Recovering Fuel From Subterranean Fuel-Carrying Deposits by Heating in Their Natural Location Using a Chain Heat Transfer Member. (Assigned to Svenska Skifferolje Aktiebolaget, Orebro, Sweden.) U.S. Patent 2,789,805, Apr. 23, 1957.
51. Marx, J. W., and Parker, H. W. Process for Recovery of Petroleum From Sands and Shale. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,813,583, Nov. 19, 1957.
52. Morse, R. A. Oil Recovery by Underground Combustion. (Assigned to Pan American Petroleum Corp.) U.S. Patent 2,793,696, May 28, 1957.
53. Simm, C. N., and De Priester, C. L. Method of Reestablishing In Situ Combustion in Petroliferous Formations. (Assigned to California Research Corp.) U.S. Patent 2,793,697, May 28, 1957.

1958

54. Dixon, H. O. Recovering Oils From Formations. U.S. Patent 2,862,558, Dec. 2, 1958.
55. Marx, J. W., and Mehmet, R. T. Oil Recovery by In Situ Combustion. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,853,137, Sept. 23, 1958.
56. Moore, T. V., and Hottel, H. C. Process for the Recovery of Oil From Subterranean Reservoirs. (Assigned to Jersey Production Research Co.) U.S. Patent 2,853,136, Sept. 23, 1958.
57. Tadema, H. J., and Quant, J. T. Process for Igniting Hydrocarbon Materials Present Within Oil-Bearing Formations. (Assigned to Shell Development Co.) U.S. Patent 2,863,510, Dec. 9, 1958.
58. Utenhove, G. F. L., Baron van, Tadema, H. J., and Kets, D. C. Petroleum Production by Underground Combustion. U.S. Patent 2,862,557, Dec. 2, 1958.
59. Walter, H. Method and Arrangement of Apparatus for Oil Recovery. (Assigned to Worthington Corp.) U.S. Patent 2,823,752, Feb. 18, 1958.
60. ———. Method for Oil Recovery With "In Situ" Combustion. (Assigned to Worthington Corp.) U.S. Patent 2,839,141, June 17, 1958.
61. Watson, K. M. Oil Recovery by Subsurface Thermal Processing. U.S. Patent 2,825,408, Mar. 4, 1958.

1959

62. Allen, J. C., and Kunetka, R. E. In Situ Combustion Within a Subsurface Formation Containing Petroleum Hydrocarbons. (Assigned to The Texas Co.) U.S. Patent 2,871,941, Feb. 3, 1959.
63. Carpenter, P. G. Recovery of Hydrocarbons From Oil-Bearing Strata. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,880,802, Apr. 7, 1959.
64. Eurenius, M. O., and Persson, B. Apparatus for Recovering Combustible Substances From Subterraneous Deposits In-Situ. (Assigned one-half to Svenska Skifferolje Aktiebolaget, Orebro, Sweden, and one-half to Husky Oil Co.) U.S. Patent 2,890,775, June 16, 1959.
65. Garrison, A. D., and Kunetka, R. E. In Situ Combustion. (Assigned to The Texas Co.) U.S. Patent 2,871,942, Feb. 3, 1959.
66. Hoffström, N. A., and Eurenius, M. O. Apparatus for Recovering Combustible Substances From Subterraneous Deposits In-Situ. (Assigned one-half to Svenska Skifferolje Aktiebolaget, Orebro, Sweden, and one-half to Husky Oil Co.) U.S. Patent 2,890,754, June 16, 1959.
67. Morse, R. A., and Rzasa, M. J. Heavy Oil Recovery. (Assigned to Pan American Corp.) U.S. Patent 2,881,838, Apr. 14, 1959.
68. Parker, H. W. Initiating In Situ Combustion in a Stratum. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,880,803, Apr. 7, 1959.
69. Parker, H. W. Recovery of Hydrocarbons by In-Situ Combustion. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,888,987, June 2, 1959.
70. Schleicher, A. R. Oil Recovery by In-Situ Combustion. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,889,882, June 9, 1959.
71. Tadema, H. J. Producing Petroleum by Underground Combustion. (Assigned to Shell Development Co.) U.S. Patent 2,874,777, Feb. 24, 1959.
72. Trantham, J. C., and Dixon, H. O. Oil Recovery by In-Situ Combustion. (Assigned to Phillips Petroleum Co.) U.S. Patent 2,889,881, June 9, 1959.
73. Williams, P. S. Secondary Recovery Process. (Assigned to Jersey Production Research Co.) U.S. Patent 2,876,838, Mar. 10, 1959.

LITERATURE REFERENCES [4]

1835–1930

74. Anzelius, A., von. Über Erwärmung Vermittels Durchströmender Medien. [Heating porous media by passing liquid through its interstices.] Ztschr. angew. Mathematik u. Mechanik, vol .6, August 1926, pp. 291–294.
75. Howard, F. A. Patents Method of Distilling Crude Oil Underground in Worn-Out Fields. Nat. Petrol. News, vol. 16, No. 9, Feb. 27, 1924, pp. 97–99.
76. Lindsly, B. E. Oil Recovery by Use of Heated Gas. Oil Gas Jour., vol. 27, No. 31, Dec. 20, 1928, pp. 27, 75–76.
77. Mills, R. Van A. Some Methods of Dealing With Paraffin Problems in Oil Wells. Part I. Nat. Petrol. News, vol. 15, No. 52, Dec. 26, 1923, pp. 58–62; Part II. Nat. Petrol. News, vol. 16, No. 1, Jan. 2, 1924, pp. 67, 69–70, 78.
78. National Petroleum News. Hope Tries Flame in Well to Remove Paraffin. Vol. 15, Pt. 3, Apr. 22, 1923, pp. 91, 94.
79. Nusselt, W. Die Theorie Des Winderhitzers. [The Theory of Blast-Air Heating.] Ztschr. Ver. deut. Ing., vol. 71, Pt. 1, Jan. 15, 1927, pp. 85–91.
80. Poisson, S. D. Theorie mathematique de la chaleur. Bachelier, Paris, France, 1835.
81. Riker, M. D. Why Not Put the Water in an Oil Well to Work?—A Suggestion on Heating. Nat. Petrol. News, vol. 18, No. 12, Mar. 24, 1926, pp. 82–83.
82. Schaller, A., and Bjornsson, P. A. Influence of Heat Upon the Recovery of Oil by Water Displacement. Nat. Petrol. News, vol. 15, No. 45, Nov. 7, 1923, p. 53.
83. Schumann, T. E. W. Heat Transfer: A Liquid Flowing Through a Porous Prism. Jour. Franklin Inst., vol. 208, 1929, pp. 405–416.
84. Smith, E. E. Successful Method of Melting Paraffin in Wells Found by Hope Company. Nat. Petrol. News, vol. 17, No. 4, Jan. 28, 1925, pp. 55–60.

1931–40

85. Birch, F., and Clark, H. The Thermal Conductivity of Rocks and Its Dependence Upon Temperature and Composition. Parts I and II. Am. Jour. Sci., vol. 238, No. 8, August 1940, pp. 529–558; No. 9, September 1940, pp. 613–635.
86. Furnas, C. C. Heat Transfer From a Gas Stream to a Bed of Broken Solids. Bureau of Mines Bull. 361, 1932, 88 pp.
87. Lapuk, B. B. [Results of the Investigation of Subterranean Gasification of Oil Sands.] Azerbaidzhanskoe Neftyanoe Khoz., No. 2, 1939, pp. 31–36.
88. ———. [Heat Treatment of Oil Sands To Increase the Recovery of Oil.] Azerbaidzhanskoe Neftyanoe Khoz., No. 12, 1939, pp. 10–15.
89. Reistle, C. E., Jr. Paraffin and Congealing-Oil Problems. Bureau of Mines Bull. 348, 1932, pp. 89–97.
90. Sage, B. H., Schaafsma, J. G., and Lacey, W. N. Pressure-Volume-Temperature Relations and Thermal Properties of Propane. Ind. Eng. Chem., vol. 26, No. 11, November 1934, pp. 1218–1224.
91. Schumann, T. E. W., and Voss, V. Heat Flow Through Granulated Material. Fuel, vol. 13, 1934, pp. 249–256.
92. Sheĭnman, A. B. [Secondary Recovery and Underground Gasification of Oil Deposits.] Novosti Tekhniki, No. 15, 1939, pp. 30–33.
93. Sheĭnman, A. B., and Dubrovaĭ, K. K. [Underground Gasification of Oil Formations and Thermal Methods of Oil Production.] Moscow, 1934, p. 26.
94. Sheĭnman, A. B., Dubrovaĭ, K. K., Sorokin, N. A., Charuigin, M. M., Zaks, S. L., and Zinchenko, K. E. [Gasification of Crude Oil in Reservoir Sands.] Neftyanoe Khoz., vol. 28, No. 4, April 1935, pp. 48–61; English trans. by A. A. Boehtlingk, Petrol. Eng., vol. 10, No. 3, December 1938, pp. 27–30; No. 5, February 1939, pp. 91–92, 94, 96, 98, 100.
95. Stovall, S. L. Recovery of Oil From Depleted Sands by Means of Dry Steam. Oil Weekly, vol. 74, No. 9, Aug. 13, 1934, pp. 17, 19–21, 24.
96. Tucker, M. Secondary Recovery Methods Used To Revive Bellevue Pool. Oil Gas Jour., vol. 35, No. 37, Jan. 28, 1937, pp. 172–173, 176.

1941–45

97. Bruce, W. A. An Electrical Device for Analyzing Oil-Reservoir Behavior. Petrol. Devel. and Technol., Trans. AIME, vol. 151, 1943, pp. 112–124.
98. Eaton, F. V. Application of Heat Increases Production in Wyoming Field. Oil Gas Jour., vol. 41, No. 50, Apr. 22, 1943, pp. 88, 102–103.
99. Emmons, H. W. The Numerical Solution of Heat-Conduction Problems. Jour. Appl. Mech., Trans. ASME, vol. 10, 1943, p. 607.
100. Gamson, B. W., Thodos, G., and Hougen, O. A. Heat, Mass and Momentum Transfer in the Flow of Gases Through Granular Solids. Trans. AICE, vol. 39, Feb. 25, 1943, pp. 1–35.
101. Gibbon, A. Thermal Principle Applied to Secondary Oil Recovery. Oil Weekly, vol. 115, No. 10, Nov. 6, 1944, pp. 170, 172.
102. Harbert, W. D., Cain, D. C., and Huntington, R. L. Unsteady Flow of Heat Through Porous Media. Ind. Eng. Chem., vol. 33, No. 2, February 1941, pp. 257–263.
103. Paschkis, V., and Baker, H. D. A Method for Determining Unsteady-State Heat Transfer by Means of an Electrical Analogy. Trans. ASME, vol. 64, 1942, pp. 105–112.
104. Producers Monthly. Shot Gun Shells Used in the Removal of Paraffin and Residue From Oil Wells. Vol. 8, No. 6, April 1944, p. 20.
105. Walter, J. E. Rate Dependent Chromatographic Absorption. Jour. Chem. Phys., vol 13, 1945, pp. 332–336.
106. Zaks, S. L. [Effect of Temperature on Elimination of Oil From Loose Sands in Gravity Flow.] Bull. acad. sci. U.R.S.S., 1944, pp. 729–733; trans. No. 538, Universal Oil Products Co. Survey of Foreign Petrol. Literature, Sept. 21, 1945.

1946–50

107. Chemical and Engineering News. Electrocarbonization of Coal. Vol. 28, No. 3, Jan. 16, 1950, p. 180.
108. Coal Age. Unmined Coal Gasified by Electric Power. Vol. 55, No. 12, December 1950, p. 130.
109. Dusinberre, G. M. Numerical Analysis of Heat Flow. McGraw-Hill Book Co., New York, N.Y., 1949.

---

[4] Titles enclosed in brackets are translations from the language in which the item was published.

110. Edmister, W. C. Applications of Thermodynamics to Hydrocarbon Processing. Part 13—Heat Capacities. Petrol. Refiner, vol. 27, No. 11, November 1948, pp. 609–615.

111. Hausen, H. Counter Current, Parallel Currents, and Cross Current Heat Transfer. Warmeubertragung im Gegenstrom, Gleichström und Kreuzström. Tech. Phy. in Einzelderstellungen, vol. 8, Springer-Verlag, Berlin, Germany 1950.

112. Jakob, M. Heat Transfer, John Wiley and Sons, New York, N.Y., vol. 1, 1949, 758 pp.

113. Johnston, K. H., and Riggs, C. H. Secondary-Recovery Practices and Oil Reserves in the Eastern Part of Delaware-Childers Field, Nowata County, Okla. Bureau of Mines Rept. of Investigations 4019, 1946, 50 pp.

114. Jones, G. W., Kennedy, R. E., and Spolan, I. Effect of High Pressures on the Flammability of Natural Gas-Air-Nitrogen Mixtures. Bureau of Mines Rept. of Investigation 4557, 1949, 16 pp.

115. Klinkenberg, A. Numerical Evaluation of Equations Describing Transient Heat and Mass Transfer in Packed Solids. Ind. Eng. Chem., vol. 40, No. 10, Oct. 1948, pp. 1992–1994.

116. Ledoux, E. Dynamic Cooling of Absorbent Beds. Ind. Eng. Chem., vol. 40, No. 10, October 1948, pp. 1970–1977.

117. Löf, G. O. G., and Hawley, R. W. Unsteady-State Heat Transfer Between Air and Loose Solids. Ind. Eng. Chem., vol. 40, No. 6, June 1948, pp. 1061–1070.

118. Odell, W. M., and Baldeschwielen, E. L. European Shale-Treating Practice. Bureau of Mines Inf. Circ. 7348, 1946, 70 pp.

119. Salomonsson, G. Ljungström In-Situ Shale Oil Process. Fluid Handling, No. 12, 1950, pp. 379–381.

120. Saunders, O. A., and Smoleniec, S. Heat Regenerators. Proc. 7th International Cong. Appl. Mech. (London), vol. 3, September 1948, pp. 91–105.

121. Tipler, W. An Electrical Analogue to the Heat Regenerator. Proc. 7th International Cong. Appl. Mech. (London), vol. 3, September 1948, pp. 196–210.

122. Wilhelm, R. H., Johnson, W. C., Wynkoop, R., and Collier, D. W. Reaction Rate, Heat Transfer, and Temperature Distribution in Fixed-Bed Catalytic Converters. Solution by Electrical Network. Chem. Eng. Prog., vol. 44, No. 2, February 1948, pp. 105–116.

1951

123. Davis, C. M., and Coffer, H. A Thermal Method of Tertiary Recovery of Oil. Oil Gas Jour., vol. 49, No. 46, Mar. 22, 1951, pp. 84–85.

124. Engelberts, W. F., and Klinkenbert, L. J. Laboratory Experiments on the Displacement of Oil by Water From Packs of Granular Material. Chap. in Proc. Third World Petrol. Cong., The Hague, 1951, Section II, E. J. Brill, Leiden, Netherlands, 1951, pp. 544–554.

125. Jenkins, R., Brough, H. W., and Sage, B. H. Prediction of Temperature Distribution in Turbulent Flow. Application of the Analog Computer. Ind. Eng. Chem., vol. 43, No. 11, November 1951, pp. 2483–2486.

126. Miller, F. G. Steady Flow of Two-Phase Single-Component Fluids Through Porous Media. Petrol. Devel. and Technol., Trans. AIME, vol. 192, 1951, pp. 205–216.

127. Torrey, P. D. New and Suggested Techniques for Improving the Recovery of Oil. Petrol. Eng., vol. 23, No. 8, July 15, 1951, pp. E–2, E–6, E–9, E–12, E–13, E–14, E–16, E–18.

128. Winkler, A. K. The Exploitation of Oil-Fields of Extremely High Oil-Viscosity by Wells, Under the Application of Thermal Energy. Chap. in Proc. Third World Petrol. Cong., The Hague, 1951, Section II. E. J. Brill, Leiden, Netherlands, 1951, pp. 528–543.

1952

129. Coward, H. F., and Jones, G. W. Limits of Flammability of Gases and Vapors. Bureau of Mines Bull. 503, 1952, 155 pp.

130. Hill, T. W. W. Electro-Thermal Recovery of Petroleum. Producers Monthly, vol. 16, No. 11, September 1952, pp. 14–20.

131. Slezak, J. M., and Davis, C. M. Pyrovolatilization, A New In Situ Recovery Method as Applied to the Bradford Third Sand. Producers Monthly, vol. 16, No. 7, May 1952, pp. 11–15.

132. Smaele, A. De. [Contribution to Underground Gasification of Coal With Oxygen and Steam.] Ann. Min. Belg., vol. 51, July 1952, pp. 544–574.

133. Squires, F., and Merriam, E. S. Oil Production by Heat From Burning Coal Veins. Producers Monthly, vol. 16, No. 5, March 1952, pp. 34–36.

134. ———. A Burner for Underground Generation of Heat. Producers Monthly, vol. 16, No. 7, May 1952, pp. 24, 26–29.

1953

135. Breston, J. N., and Pearman, B. R. Hot Water Injection Treatment of Wells to Increase Water Intake Rates. Producers Monthly, vol. 18, No. 1, November 1953, pp. 15–23.

136. Business Week. A Hotfoot for Unrecoverable Oil. No. 1267, Dec. 12, 1953, pp. 78, 80.

137. Goldstein, S. On the Mathematics of Exchange Processes in Fixed Columns. I-Mathematical Solutions and Asymptotic Expansions. Proc. Roy. Soc. (London), vol. 219, ser. A, 1953, pp. 151–171.

138. Greenstein, R. I., and Preston, F. W. Heat Gain by Unconsolidated Sands During Hot Water Injection. Producers Monthly, vol. 17, No. 4, February 1953, pp. 16–23.

139. Kuhn, C. S., and Koch, R. L. In Situ Combustion, Newest Method of Oil Recovery. Oil Gas Jour., vol. 52, No. 14, Aug. 10, 1953, pp. 92–96, 113–114.

140. Oil and Gas Journal. Sinclair Gets Patent on New Oil-Recovery Process. Vol. 52, No. 16, Aug. 24, 1953, pp. 111–113.

141. Pennsylvania State University. Mineral Industries Experiment Station. Heat Injection Into Porous Media. API Res. Grant-in-Aid, Quarterly Progress Rept., July 14, 1953.

142. Salomonsson, G. Ljungström Method for Underground Pyrolysis of Shale. Iva, vol. 24, 1953, pp. 118–123.

143. Silver, R. S. Theoretical Treatment of Combustion in Fuel Beds. Parts I and II. Fuel, vol. 32, No. 2, April 1953, pp. 121–150.

144. Torrey, P. D. Prospects for Improving Oil Recovery. Petrol. Eng., vol. 25, No. 3, March 1953, pp. B–12, B–14, B–16, B–18.

1954

145. Allen, H. E., and Davis, R. K. Electric Formation Heaters Boost Cut Bank Production. Oil Gas Jour., vol. 53, No. 6, June 14, 1954, pp. 125–127.

146. Buffum, F. G. Flame Flooding. Petrol. Eng., vol. 26, No. 6, June 1954, pp. B–99, B–100.

147. Cheasley, T. C., Forrester, J. D., and Sarapuu, E. Underground Electrocarbonization of Coal and Related Hydrocarbons. Trans. AIME, Mining Branch Tech. Paper 3873–F, vol. 199, 1954, pp. 908–915; Min. Eng., vol. 6, No. 9, September 1954, pp. 908–915.

148. Grant, B. F., and Szasz, S. E. Development of an Underground Heat Wave for Oil Recovery. Petrol. Devel. and Technol., Trans. AIME, vol. 201, 1954, pp. 108–118; Jour. Petrol. Technol. vol. 6, No. 5, May 1954, pp. 23–33.

149. Guile, A. E., and Carne, E. B. Analogue Solution of Heat Conduction Problems. Elec. Eng., vol. 73, No. 3, March 1954, p. 224.

150. Hester, D. V. Surface Combustion Drive for Recovery of Oil. Thesis Master Chemical Engineer, Univ. of Okla., 1954.

151. Hester, D. V., and Menzie, D. E. Development of Subsurface Combustion Drive. Petrol. Eng., vol. 26, No. 12, November 1954, pp. B–82, B–87–B–92.

152. Jenkins, R., and Aronofsky, J. S. Analysis of Heat Transfer Processes in Porous Media—New Concepts in Reservoir Heat Engineering. Proc. Eighteenth Tech. Conf. on Petrol. Production, Pennsylvania State Univ., Miner. Ind. Exp. Sta. Bull. 64, Oct. 6–8, 1954, pp. 69–74.

153. Koch, R. L., Gleason, J. F., Jr. and Boston, W. G. In Situ Combustion Field-Tested Again. Oil Gas Jour., vol. 53, No. 31, Dec. 6, 1954, pp. 102–106.

154. McAdams, W. H. Heat Transmission. 3d ed. McGraw-Hill Book Co., New York, N.Y., 1954, 532 pp.

155. Munk, W. The Delayed Hot-Water Problem. Jour. Appl. Mech., Trans. ASME, vol. 21, June 1954, p. 193.

156. Pennsylvania Grade Crude Oil Association. Secondary Recovery Research Report. No. 34, June 2, 1954, pp. 2, 5.

157. Preston, F. W., and Hazen, R. D. Further Studies on Heat Transfer in Unconsolidated Sands During Water Injection. Producers Monthly, vol. 18, No. 4, February 1954, pp. 24–34.

158. Ramey, H. J., Jr., and Nabor, G. W. A Blotter-Type Electrolytic Model Determination of Areal Sweeps in Oil Recovery by In Situ Combustion. Jour. Petrol. Technol., vol. 6, No. 5, May 1954, pp. 35–39; Petrol. Devel. and Technol., Trans. AIME, vol. 201, 1954, pp. 119–123.

159. Saxon, J., Jr. Magnolia Petroleum Company's In Situ Combustion Method for Oil Recovery. Producers Monthly, vol. 18, No. 5, March 1954, pp. 18–20.

160. Walker, E. W. Down-the-Well Heating. Petrol. Eng., vol. 26, No. 13, December 1954, pp. B–36c, 36d, B–40, B–43.

161. West, W. J., Garvin, W. W., and Sheldon, J. W. Solution of the Equations of Unsteady State Two-Phase Flow in Oil Reservoirs. Petrol. Devel. and Technol., Trans. AIME, vol. 201, 1954, pp. 217–229.

162. World Oil. Research Facilities on In-Situ Combustion of Oil. Vol. 139, No. 2, Aug. 1, 1954, pp. 163–166.

1955

163. Asaad, Y. A Study of the Thermal Conductivity of Fluid Bearing Porous Rocks. Ph.D. Thesis, Univ. of Calif., June 1955.

164. Chemical and Engineering News. Thermal Recovery Tested. Vol. 33, No. 42, Oct. 17, 1955, p. 4406.

165. Hadidi, T. A. R., Nielsen, R. F., and Calhoun, J. C., Jr. Studies on Heat Transfer During Linear Fluid Displacement in Porous Media. Proc. Nineteenth Tech. Conf. on Petrol. Production, Pennsylvania State Univ., Miner. Ind. Exp. Sta. Bull. 68, 1955, pp. 29–34.

166. Jenkins, R., and Aronofsky, J. S. Analysis of Heat Transfer Processes in Porous Media—New Concepts in Reservoir Heat Engineering. Producers Monthly, vol. 19, No. 5, March 1955, pp. 37–41.

167. Lauwerier, H. A. The Transport of Heat in an Oil Layer Caused by the Injection of Hot Fluid. Appl. Sci. Res., vol. 145, 1955, p. A5.

168. Melby, T. S. An Evaluation of Bottom-Hole Heating on Well Performance. AIME Tech. Paper 575–G, pres. at Southern California Petrol. Sec., AIME, Los Angeles, Calif., Oct. 20–21, 1955.

169. Miller, F. G., and Seban, R. A. The Conduction of Heat Incident to the Flow of Vaporizing Fluids in Porous Media. Jour. Petrol. Technol., vol. 7, No. 12, December 1955, pp. 45–47.

170. Oil and Gas Journal. Sinclair to Test New Oil-Recovery Method. Vol. 53, No. 49, Apr. 11, 1955, p. 81.

171. ———. "Fire-Flood" Set. Vol. 54, No. 12, July 25, 1955, pp. 132–133.

172. ———. SOCAL Tests "Fire Drive." Vol 54, No. 16, Aug. 22, 1955, pp. 98–99.

173. Parrent, K. G. Bottom Hole Heaters. Petrol. Eng., vol. 27, No. 5, May 1955, pp. B–41, B–42, B–44, B–46.

174. Spalding, D. B. Some Fundamentals of Combustion. Gas Turbine Series, vol. 2, Academic Press, Inc., New York, N.Y., 1955, p. 95.

175. Van Heiningen, J., and Schwarz, N. Recovery Increased by Thermal Drive. World Oil, vol. 141, No. 5, October 1955, pp. 230, 232, 234; Proc. Fourth World Petrol. Cong., Rome, Italy, June 6–15, 1955, sec. 2. Carlo Colombo, Rome, Italy, 1955, pp. 299–312.

176. Vogel, L. C., and Krueger, R. F. An Analog Computer for Studying Heat Transfer During a Thermal Recovery Process. Jour. Petrol. Technol., vol. 7, No. 12, December 1955, pp. 205–211.

177. Wyllie, M. R. J., and Gregory, A. R. Fluid Flow Through Unconsolidated Porous Aggregates. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1379–1388.

1956

178. Chemical and Engineering News. Trial by Fire. Vol. 34, No. 33, Aug. 13, 1956, pp. 3864–3865.

179. Garbus, R. Here's A New Recovery Method. Oil Gas Jour., vol. 54, No. 48, Apr. 2, 1956, pp. 94–95.

180. ———. New Idea in Thermal Oil Recovery. Petrol. Eng., vol. 28, No. 4, April 1956, pp. B–83, B–84, B–86.

181. Oil and Gas Journal. Warm-Water Drive May Bring Big Payoff. Vol. 54, No. 58, June 11, 1956, pp. 80–81.

Original from THE OHIO STATE UNIVERSITY

182. Oil and Gas Journal. Torch Applied to "Fire Flood" Project. Vol. 54, No. 62, July 9, 1956, p. 62.

183. ———. Experiment Ignited. Vol. 54, No. 64, July 23, 1956, p. 69.

184. Oil Forum. Oil Recovery by Fire Flood. Vol. 10, No. 11, November 1956, p. 387.

185. Petroleum Week. Thermal Recovery Gets a Payoff Test in California. Vcl. 3, No. 4, July 27, 1956, pp. 14–15.

186. Squires, F. Secondary Recovery, Early and Late. Oil Gas Compact Bull., vol. 15, No. 1, June 1956, pp. 55–63.

187. Stone, H. L., and Crump, J. S. The Effect of Gas Composition Upon Oil Recovery by Gas Drive. Petrol. Devel. and Technol., Trans. AIME, vol. 207, 1956, pp. 105–110.

188. Terwilliger, P. L. In-Situ Combustion Method of Producing Oil. Producers Monthly, vol. 20, No. 12, October 1956, p. 9.

189. Uchara, I. The Studv of Oil Recovery Process by Fire Flood Method. No. 1. Jour. Japanese Assoc. Petrol. Tech., 21, No. 5, 1956.

190. Zierfuss, H., and Vliet, G. van der. Laboratory Measurements of Heat Conductivity of Sedimentary Rocks. Bull. Am. Assoc. Petrol. Geol., vol. 40, No. 10, October 1956, pp. 2475–2488.

1957

191. CEC Recordings. Heat Wave for Oil Recovery. Vol. 11, No. 3, May–June 1957, pp. 3–5.

192. Conservation Committee of California Oil Producers. Annual Review of California Crude-Oil Production 1956. 1957, p. 53.

193. Gibbon, A. Is This the Answer to Athabaska Tar Sand Riddle? World Oil, vol. 145, No. 7, December 1957, pp. 171, 174, 177.

194. Oil and Gas Journal. New Recovery Firm. Vol. 55, No. 42, Oct. 21, 1957, pp. 84–85.

195. Petroleum Week. Another Thermal Recovery Project—Third in the State—Has Been Started in California. Vol. 4, No. 12, Mar. 22, 1957, p. 31.

196. ———. Production's Big Goal: Recover More Oil More Cheaply From Known Reserves. Special Report/Production. Vol. 5, No. 11, Sept. 13, 1957, pp. 47–50, 53–54, 57–58.

197. ———. In Situ Combustion May be Used to Recover Heavy Bitumen From Asphalt Ridge, in Utah's Uinta Basin. Vol. 5, No. 24, Dec. 13, 1957, p. 34.

198. Schild, A. A Theory for the Effect of Heating Oil Producing Wells. Petrol. Devel. and Technol., Trans. AIME, vol, 210, 1957, pp. 1–10.

199. Stormont, D. H. Bottom-Hole Heating Speeds Flow of Heavy California Oil. Parts 1 and 2. Oil Gas Jour., vol. 55, No. 25, June 24, 1957, pp. 142–144, 147, 149, 151; No. 26, July 1, 1957, pp. 119–120, 124, 126–127.

200. Uchara, I., and others. The Study of Oil Recovery Process by Fire Flood Method. No. 2. Jour. Japanese Assoc. Petrol. Tech., 22, No. 2, 1957.

201. ———. The Study of Oil Recovery Process by Fire Flood Method. No. 3. Jour. Japanese Assoc. Petrol. Tech., 22, No. 5, 1957.

202. Walter, H. Application of Heat for Recovery of Oil: Field Test Results and Possibility of Profitable Operation. Jour. Petrol. Technol., vol. 9, No. 2, February 1957, pp. 16–22.

1958

203. Anz, J., and Clark, A. Thermal-Recovery—A Moving Inferno. Texas A&M Engineer, vol. 13, No. 5, May 1958, pp. 16–17, 30, 32.

204. Benham, A. L., and Poettmann, F. H. The Thermal Recovery Process—An Analysis of Laboratory Combustion Data. Jour. Petrol. Technol., vol. 10, No. 9, September 1958, pp. 83–85.

205. Breston, J. N. Recovering Oil by Fire Flooding. Monitor, vol. 3, No. 4, July–August 1958, pp. 4–7.

206. ———. Oil Recovery by Heat from In Situ Combustion. Jour. Petrol. Technol., vol. 10, No. 8, August 1958, pp. 13–17.

207. Chemical Week. Boosting Recovery of Sand-Trapped Oil. Vol. 83, No. 11, Sept. 13, 1958, pp. 79–80.

208. Clark, N. J. Two New Recovery Processes. Oil Gas Jour., vol. 56, No. 40, Oct. 6, 1958, pp. 220–222.

209. Gates, C. F., and Ramey, H. L., Jr. Field Results of South Belridge Thermal Recovery Experiment. Petrol. Devel. and Technol., Trans. AIME, vol. 213, 1958, pp. 236–244.

210. Kalivoda, F. E., and Miesse, C. C. Combustion in Porous Media. Pres. at Petrol. Eng. Conf. on Secondary Recovery, Univ. of Ill., Urbana, Ill., Sept. 25–27, 1958, 21 pp.

211. Martin, W. L., Alexander, J. D., and Dew, J. N. Process Variables of In Situ Combustion. Petrol. Devel. and Technol., Trans. AIME, vol. 213, 1958, pp. 28–35; Jour. Petrol. Technol., vol. 10, No. 2, February 1958, pp. 28–35.

212. McNiel, J. S., Jr., and Moss, J. T. Recent Progress in Oil Recovery by In Situ Combustion. Texas Petrol. Research Committee, Proc. Eleventh Oil Recovery Conf. Bull. 67, Univ. of Texas, Austin, Tex., May 8–9, 1958, pp. 84–99; Petrol. Eng., vol. 30, No. 7, July 1958, pp. B-29–B-32, B-36, B-41–B-42.

213. ———. In Situ Combustion. Oil Gas Jour., vol. 56, No. 37, Sept. 15, 1958, pp. 232, 235–241.

214. Moss, J. T., White, P. D., and McNeil, J. S. Jr. In-Situ Combustion Process—Results of a Five Well Field Experiment in Southern Oklahoma. AIME Tech. Paper 1102-G, pres. at 33d Annual Fall Meeting, Soc. of Petrol. Eng., AIME, Houston, Tex., Oct. 5–8, 1958. See reference **239**.

215. Nakayama, K. The Study of Oil Recovery Process by Fire Flood Method. No. 4—Experiment in Niitsu Oil Field. Jour. Jap. Petrol. Inst., vol. 2, 1958.

216. Nelson, T. W., and McNiel, J. S., Jr. In Situ Combustion Can Be Profitable. Petrol. Week, vol. 7, No. 24, Dec. 12, 1958, pp. 17–18.

217. Oil and Gas Journal. Fire Flood Works, But Costs are High. Vol. 56, No. 35, Sept. 1, 1958, pp. 106–107.

218. ———. Fire Flood Okayed. Vol. 56, No. 37, Sept. 15, 1958, p. 117.

219. ———. New Bottom-Hole Heat Pump Melts Oil Block. Vol. 56, No. 38, Sept. 22, 1958, p. 61.

220. ———. Fire Recovery Planned. Vol. 56, No. 38, Sept. 22, 1958, p. 69.

221. ———. Plug for Fire Floods. Vol. 56, No. 49, Dec. 8, 1958, p. 45.

222. Petroleum Week. Texas Fireflood Solves Some Problems. Vol. 7, No. 3, July 18, 1958, pp. 22, 24, 26, 28.

223. ———. Another Thermal Recovery Project Has Been Proposed in Texas. Vol. 7, No. 8, Aug. 22, 1958, p. 22.

224. ———. California Fireflood Works, But. Vol. 7, No. 9, Aug. 29, 1958, p. 19.

225. ———. John H. DeFord Will Conduct a Pilot Thermal Recovery Project in Coleman County, Southwest Texas. Vcl. 7, No. 13, Sept. 26, 1958, p. 34.

226. Petroleum Week. Shell Starts Recovery Tests. Vol. 7, No. 16, Oct. 17, 1958, pp. 50, 52.

227. ———. Continue Texas Fireflood. Vol. 7, No. 25, Dec. 19, 1958, p. 23.

228. Rassegna Petrolifera. Metodi Termici Usati nell' URSS per l'Estrazione di Greggi Pesanti. [Thermal Method Used in U.S.S.R. for Producing Heavy Crude.] Vol. 24, No. 521, Oct. 28, 1958, p. 924.

229. Roberts, G., Jr., and Geffen, T. M. Fluid Injection for Oil Recovery. Oil Gas Jour., vol. 56, No. 34, Aug. 25, 1958, pp. 86–87, 90–92.

230. Slobod, R. L. A Review of Methods Used to Increase Oil Recovery. Producers Monthly, vol. 22, No. 4, February 1958, pp. 24–31.

231. Somerton, W. H. Some Thermal Characteristics of Porous Rocks. Jour. Petrol. Technol., vol. 10, No. 5, May 1958, pp. 61–64.

232. Stepp, V. E., and Brownscombe, E. R. Maximum Recovery. How Far Have We Come? Oil Gas Jour., vol. 56, No. 35, Sept. 1, 1958, pp. 171–173, 175, 178.

233. Swaminathan, V. S. 50% Recovery by Fire Drive. Oil Gas Jour., vol. 56, No. 22, June 2, 1958, pp. 129, 131.

234. Wilson, L. A., Wygal, R. J., Reed, D. W., Gergins, R. L., and Henderson, J. H. Fluid Dynamics During an Underground Combustion Process. Petrol. Devel. and Technol., Trans. AIME, vol. 213, 1958, pp. 146–154.

1959

235. Bailey, H. R., and Larkin, B. K. Heat Conduction in Underground Combustion. Jour. Petrol. Technol., vol. 11, No. 5, May 1959, p. 74A.

236. Fuchida, T. Laboratory and Field Experiments on Fire-Flood Recovery Method. Pres. at Fifth World Petrol. Congress, New York, N.Y., May 31–June 5, 1959, Section II, Paper 21, 12 pp.; Producers Monthly, vol. 23, No. 9, July 1959, pp. 30–35.

237. Hujsak, K. L. In-Situ Combustion May Be Key to Economic Release of Oil From Alberta's Athabasca Tar Sands. Petrol. Week, vol. 8, No. 20, May 15, 1959, p. 75.

238. McNeil, J. S., Jr., and Nelson, T. W. Thermal Methods Provide Three Ways to Improve Oil Recovery. Oil Gas Jour., vol. 57, No. 3, Jan. 19, 1959, p. 86–98.

239. Moss, J. T., White, P. D., and McNeil, J. S., Jr. In Situ Combustion Process—Results of a Five-Well Field Experiment in Southern Oklahoma. Jour. Petrol. Technol., vol. 11, No. 4, April 1959, pp. 55–64; Petrol. Devel. and Technol., Trans. AIME, vol. 216, 1959, pp. 55–64. See reference **214.**

240. Nelson, T. W., and McNeil, J. S., Jr. Oil Recovery by Thermal Methods. Parts 1 and 2. Petrol. Eng., vol. 31, No. 2, February 1959, pp. B–27–B–32; No. 3, March 1959, pp. B–75, B–79, B–82, B–88, B–92, B–99, B–100.

241. Oil and Gas Journal. In-Situ Combustion Has Come to Venezuela. Oil Gas Jour. Newsletter, vol. 57, No. 21, May 18, 1959.

242. ———. Don't Low-Rate Fire Flooding. Oil Gas Jour. Newsletter, vol. 57. No. 23, June 1, 1959.

243. Petroleum Week. Pilot Fireflood Begun in Texas. Vol. 8, No. 11, Mar. 13, 1959, p. 26.

244. ———. New Burner Helps Lift Heavy Crude. Vol. 8, No. 11, March 13, 1959, p. 30.

245. ———. Hydrogen Can Gasify Tar Sands. Vol. 8, No. 14, April 3, 1959, p. 41.

246. Ramey, H. J., Jr. Transient Heat Conduction During Radial Movement of a Cylindrical Heat Source—Applications to the Thermal Recovery Process. Jour. Petrol. Technol., vol. 11, No. 5, May 1959, p. 75.

247. Tadema, H. J. Oil Production Through Subterranean Combustion. Erdol u. Kohle (Ger). Vol. 12, No. 3, March 1959, pp. 140–144.

248. ———. Mechanisms of Oil Production by Underground Combustion. Koninklijke/Shell Exploration & Production Research Lab, Amsterdam, Netherlands. Presented at Fifth World Petrol. Cong., New York, N.Y., May 31–June 5, 1959, sec. 2, paper 22, 8 pp.

ADDENDA

249. Sheĭnman, A. B., and Sergeev, A. I. Experimental Study of Oil Recovery by Combustion In Situ. Trudy Inst. Nefti, Akad. Nauk S.S.S.R., vol. 11, 1958, pp. 228–239.

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U.S. GOVERNMENT PRINTING OFFICE: 1960